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	REFERENCE	REV
TITLE: SPECIFICATION FOR PHOTOVOLTAICS MODULES	CP_TSSPEC_303	0
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## **FOREWORD**

Recommendations for corrections, additions or deletions should be addressed to the:

Research and Asset Development General Manager

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2016

## **INTRODUCTION**

City Power has implemented sustainable energy solutions to offset the energy usage of their depots by using more sustainable energy solutions. This is in accordance with the current IRP/VUCA strategy plan towards a greener economy to lower the energy demand of City Power and City owned buildings from the grid.

### **1. SCOPE OF WORK**

The document covers only the requirements for the equipment to be used, i.e., solar PV modules. The detailed design of plant, Procurement, Construction, Commissioning is not covered in this document. All works shall be executed as described in the specifications, as well as all other supplies or works as deemed necessary for a complete and functional Solar PV system. The work shall be carried out in compliance with relevant Environmental Requirements.

### **2. NORMATIVE REFERENCES**

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

- SANS 61215: Design qualification and type test approval (Crystalline)
- SANS 61730: Photovoltaic (PV) module safety qualification
- IEC 61701: Salt mist corrosion testing of photovoltaic modules
- IEC 62716: Ammonia corrosion testing of photovoltaic modules
- IEC 62759-1: Transportation testing pf photovoltaic modules

### **3. ABBREVIATIONS**

DC- Direct current

EVA- Ethylene vinyl acetate

IRP – Integrated resource plan

kWp- Kilowatt peak

PV-Photovoltaic

MW-Mega watt

STC –Standard test condition

VUCA-Volatility, uncertainty, complexity, and ambiguity

Wp- Watt peak

## **4. REQUIREMENTS**

### **4.1 General**

This chapter describes the detailed specifications of the required Solar PV Module for the project. The Contractor is responsible for ensuring that each line item specification is adhered to in the provision of all equipment and material.

The PV Modules specified shall be a low Iron glass laminate using crystalline technology with a minimum of 60 cells. The glass laminate shall use a high grade EVA laminate material. Preferably, fly lead interconnects shall be used inclusive of an IP65 or IP67 or IP68 junction box rated which includes bypass diode protection. Furthermore, the PV module shall be framed with a sturdy anodized Aluminium frame with easy mounting holes and an earth connection.

### **4.2 PV MODULE**

The Photovoltaic (PV) modules shall meet the following minimum requirements:

- 4.2.1 The module rated peak power shall be  $\geq 355$  Wp at STC (25°C). The peak power shall be of the manufacturer's name plate data sheets for each individual module
- 4.2.2 The modules shall be crystalline material with a minimum module efficiency  $\geq 17.5\%$
- 4.2.3 Crystalline modules shall meet SANS 61215 of class II: Crystalline (mono) PV modules — Design qualification and type approval.
- 4.2.4 A certificates stating compliance to the relevant standard above shall be submitted
- 4.2.5 The module shall have a minimum performance guarantee of 80% for the

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required design life of 25 years under any prevailing site environmental conditions

- 4.2.6 Preference shall be given to Bloomberg listed Tier 1 manufacturers or a manufacturers who has 5 years' experience producing at least 150MW PV modules per year. (Tier 1 in this context refers to the Tier 1 list of Bloomberg New).
- 4.2.7 The PV module shall be on the PVEL and PV-Tech score or shall pass their tests in addition to SANS 61215.
- 4.2.8 The tolerance of the rated output of the PV modules offered shall be - 0/+5%
- 4.2.9 Sample of Flash test reports for modules shall be made available to City Power with the actual certificates of modules installed prior to installation stage
- 4.2.10 Labelling: each module shall be labelled indicating: Manufacturer, model number, serial number, maximum power point watt rating ( $W_{peak} \pm$  tolerance), maximum power point current, maximum power point voltage, open circuit voltage and short circuit current of each module and the maximum system voltage.
- 4.2.11 Each module shall be factory equipped with output cables which are connected in a weather proof junction box. The cables shall be a suitably rated solar cable.
- 4.2.12 The modules shall be framed with an anodised aluminum frame in such a way as to allow secure fastening to the PV array mounting structure.
- 4.2.13 All PV modules shall be of the same type, size and age hence interchangeable.

## **5 MATERIAL AND INSTALLATIONS**

### **5.1 PV module clamping points**

- 5.1.1 PV modules shall be installed according to the manufactures instruction to avoid damage by an accredited installer.
- 5.1.2 The mechanical stress test according to SANS 61215, the module shall be mounted as per the manufacturer's and load of 2400 Pa (push and pull 3 times) is applied
- 5.1.3 Sufficient distance between the modules to avoid needless loads shall apply
- 5.1.4 Module clamps shall be correctly selected and fit securely on the module frame

### **5.2 Connectors**

- 5.2.1 The solar PV connectors shall be MC4 male and female connector type

### **5.3 Cables**

- 5.3.1 Cables shall be UV-resistant, double insulated, ozone-resistant, temperature resistant, rubber type cable, and equivalent to 4 mm<sup>2</sup> to 6mm<sup>2</sup> solar cables

### **5.4 Outside cable laying**

- 5.4.1 Module cables and connectors shall not lie on the roof
- 5.4.2 UV protection shall be used if cables are exposed directly to the sun

### **5.5 Cable inlet**

- 5.5.1 Cable laying shall be done under consideration of fire protection and existing thermal installation

### **5.6 Inside cable laying**

- 5.6.1 Cables and other components shall be clearly marked

### **5.7 Hooks**

- 5.7.1 Number and position of the hooks shall be determined by structural analysis, rafter spacing and tile dimensions.
- 5.7.2 Screws shall withstand the loads

### **5.8 Rail Mounting**

- 5.8.1 Rail cutting: preferably on the ground to avoid metal scarf on the roof

5.8.2 A circular saw shall be used as compared to angle grinder

## **6 ROUTINE MAINTENANCE OF PHOTOVOLTAIC MODULES**

Maintenance for the Solar PV systems shall be done monthly. This includes cleaning the panels and checking all system components. Any issues raised with system components are brought to awarded contactors' attention and then rectified via a report after site inspection.

Maintenance may be required at a higher rate should the performance of the system dip below the desired outcome.

### **6.1 Constant monitoring**

The PV modules shall be constantly monitored, and informed via email if any faults occur. There shall be a 24 hour reaction time to any fault condition.

### **6.2 Monthly checks**

Maintenance of the PV modules shall be cleaned monthly to keep the production high and the following maintenance shall be done:

6.2.1 Panel cleaning (cleaned with purely water and micro-fibre brushes)

6.2.2 String test (tested with 1000V multimeter)

6.2.3 Infrared images of electrical connections

6.2.4 Overall system overview (cracks or loose connections etc.)

### **6.3 Annual service**

The annual service report shall provide preventative maintenance procedures to ensure the validity of any warranties on the system. It shall comprised mechanical and a portal (any approved/accepted software) report.

#### **6.3.1 Mechanical Inspection**

- i) Ensure all penetrations are watertight.
- ii) Check for vegetation growth, accumulation & shading.
- iii) Confirm safety signage in place as per construction file.
- iv) Confirm all electrical enclosures secure, locked and have required signage.
- v) Check all conduits/cable trays and ensure secure and in good condition.
- vi) Check for corrosion on any enclosures/trays/conduit/structure.

vii) Check for corrosion at all cable entry/exit points to conduit.

#### **6.3.2 Array/Module inspection:**

- i) Check all panels for damage/cracks, water ingress and potential hot spots.
- ii) Inspect general condition of roof sheet structure and report any signs of loose connections.
- iii) Torque all middle and end clamps to manufacturers specifications using torque wrench or similar.
- iv) Check for corrosion on any enclosures structure.
- v) Check for signs of animal drops in array.
- vi) Check labelling on cable trays and cables in order.

#### **6.4 Earthing:**

6.4.1 Check that all earthing along trunking/cable trays is present and tight.

6.4.2 Lightning protection: check finials and other protection devices are in good condition

6.4.3 Conduct grounding tests on all earthing points

### **7 TRAINING**

7.1 The suppliers shall provide comprehensive training courses on the configuration, installation, operation and maintenance of its vending.

7.2 The suppliers shall provide technical support on vending system's and equipment queries for the duration of the contract

7.3 User, Functional & System Support Training

7.3.1 Technical system support training for City Power employees

7.3.2 Training on DQM operations/monitoring/control for the managers/supervisors/data stewards

7.3.3 The service provider shall provide a copy of the training materials and user documentation to the City Power in an electronic readable and printable format.



## **8. QUALITY MANAGEMENT**

A quality management system shall be set up in order to assure the quality during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste .Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

## **9. HEALTH AND SAFETY**

A health and safety plan shall be set up in order to ensure proper management and compliance during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste. Guidance on the requirements of a health and safety plan shall be found in OHSAS 18001:2007/ ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

## **10. ENVIRONMENTAL MANAGEMENT**

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance is adhered to during manufacture, installation, removal, transportation and disposal of scrap material/Waste/E-waste. Guidance on the requirements for an environmental management system shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy.

**ITEM No. 1 SAP No. ....: PV Modules 355Wp**

**Schedule A: Purchaser's specific requirements**

**Schedule B: Guarantees and technical particulars of equipment offered**

Item No.	Description	Unit	Required	Tendered
<b>1</b>	<b>Product information</b>			
1.1	Manufacturer			
1.2	Product Type			
<b>2</b>	<b>PV Module Characteristics</b>			
2.1	PV Module technology	N/A	Crystalline(Mono)	
2.2	Module rated power (c-si )	Wp	≥ 355 Wp / ≥370Wp	
2.3	Module Efficiency	%	≥ 17.5%	
2.4	Temperature coefficient on Pmpp (negative on sign)	- %/°C	≥ - 0.38%/°C	
2.5	Nominal Power Tolerances from Manufacturer (used for acceptance to the module)	± %	0% ≤ Pnom ≤ +5% (positive tolerance only)	
2.6	Module Maximum System Voltage	V	48V	
<b>3</b>	<b>Product Warranty and Performance Guarantee</b>			
3.1	Power output guaranteed during the first year of operation	%	Minimum : 97%	
3.2	Linear degradation coefficient after year 1 to year 25	%/year	Maximum degradation of -0.7%/year	
3.3	Guaranteed output of the nominal power after 10 years	%	Minimum 90%	
3.4	Guaranteed output of the nominal power after 25 years	%	Minimum 80%	
3.5	Product Warranty against Manufacturing defects	Years	Minimum 10	
<b>4</b>	<b>Minimum Certificates for acceptance of PV modules</b>			

Item No.	Description	Unit	Required	Tendered
4.1	IEC 61730- Photovoltaic (PV) module safety class II qualification	N/A	Required	
4.2	IEC 61730-2 Testing requirements for PV modules in order to provide safe electrical and mechanical operation	N/A	Required	
4.3	SANS 61215 – PV module safety certification	N/A	Required	
4.4	UL 1703- Fire resistance rating is acceptable	N/A	Required	
4.5	CE-European conformity if exported	N/A	Required	
4.6	PV Cycle-recycling approved waste disposal	N/A	Required	
4.7	ISO 9001:2015/Quality management system	N/A	Required	
4.8	ISO 14001:2015/Standards for environmental management system	N/A	Required	
4.9	OHSAS18001:2007/international standard for occupational health and safety	N/A	Required	
<b>5</b>	<b>Documentation for evaluation of PV modules</b>			
5.1	Detailed Technical Specifications	N/A	Required	
5.2	Limited Product and Peak Power Warranty	N/A	Required	
5.3	Installation, Operation and Maintenance manual	N/A	Required	
5.4	Description of the cleaning strategy Instruction	N/A	Required	
5.5	Recycling strategy	N/A	Required	
5.6	Flash Test Report	N/A	Required	

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5.7	Potential Induced Degradation (PID) free test report	N/A	Required	
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**DEVIATION SCHEDULE:**

**ITEM No. 1 SAP No. ....: PV Modules 355Wp**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost- effective than that specified by City Power.

Item No.	Sub-clause of ?	Proposed deviation

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**ANNEX A – Bibliography**

PV GREECARD Training Material: 2019

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**Annex B - Revision information**

DATE	REV. NO.	NOTES
AUGUST 2021	0	First issue